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LONG-TERM GOAL

The goal of this research is to develop a predictive capability for the upper ocean circulation and atmospheric interactions using numerical models.

OBJECTIVE

The immediate objectives are to develop improved models of the oceans, to evaluate these models against available observations, and to develop assimilation techniques to be used in these models. In addition, we are continuing the task of preparing long-term global fluxes and wind stresses for ocean modelling.

This special ONR Grant is the base support for the FSU Center for Ocean-Atmospheric Prediction Studies. Other agencies who contribute are NASA, NSF, NOAA and JPL (NSCAT). We also have NASA monies from Oregon State University for SEAWINDS.

APPROACH

We are using a suite of models forced with estimates of real winds, with very fine horizontal resolution and realistic basin geometries. The vertical structure ranges from limited resolution, as in the reduced gravity model, to those with very high vertical resolution. The focus this year has been on the dynamical effect of large island masses on the currents of the upper Pacific Ocean. The NRL high-resolution, multi-layer Pacific ocean model is driven by a modified version of the ECMWF surface winds corresponding to 1981-1994. This a cooperative effort, with the computations done by the ocean modeling team at NRL, headed by Harley E. Hurlburt of NRL, Stennis, and the output analysis done by the scientists at Florida State, headed by Secretary of the Navy Professor James J. O'Brien.

WORK COMPLETED

Results from the numerical models were downloaded and analyzed. The specific regions of interest were extracted from the model output. Model transport, velocity, layer thickness and pressure fields were examined. Calculation of water mass transport were done and model validation was

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carried out by comparison to observations.

RESULTS

This innovative collaboration focuses on two island regions, the Hawaiian Islands and Halmahera of the Phillipine Islands. The westward ocean current impinging on Hawaii is found to be diverted northward and southward around Hawaii. The dramatic result is a shadow zone in the lee of Hawaii containing energetic ocean eddies comparable in size to the island of Hawaii (Fig. 1).

Halmahera Island is found to prevent flow of South Pacific water into the Celebes Sea, diverting some of it southward through the Seram and Banda Seas (Fig. 2). Halmahera impacts the lower thermocline and intermediate water pathways throughout the entire year, but affects the surface layer only during the northern spring and fall.

IMPACTS

This successful project was conducted as a cooperative effort between Naval and academic personnel. Topography has been shown to have a powerful effect on the ocean circulation in the regions of study. Naval operations can use this information to better understand the local environment, enhancing countermine measures and deployment.

RELATED PROJECTS

The Secretary of the Navy Chair provides the base funding for COAPS, supporting a diverse research program in oceanography and meterology. COAPS manages an ONR Minority Program which currently places 20-25 minority undergraduate science students in a laboratory-type work position with a mentoring professor. The goal is to convince these students to do graduate studies. Without the basic Secretary of Navy Grant, the ONR Minority Program would not have the infrastructure for the administration.

NSF supports the World Ocean Circulation Experiment Data Archive Center and Special Analysis Center (WOCE DAC.SAC) for surface meteorological observations. NOAA Office of Global Programs (OGP) supports the TOGA Wind Center providing Pacific Ocean winds for El Nino forecasts. NOAA OGP through its TOGA COARE program supports the Center to archive surface meteorological data.

NASA through a science grant from NASA Headquarters and the NASA Scatterometer Project at JPL provide support for basic science in utilizing scatterometer data to drive ocean models.

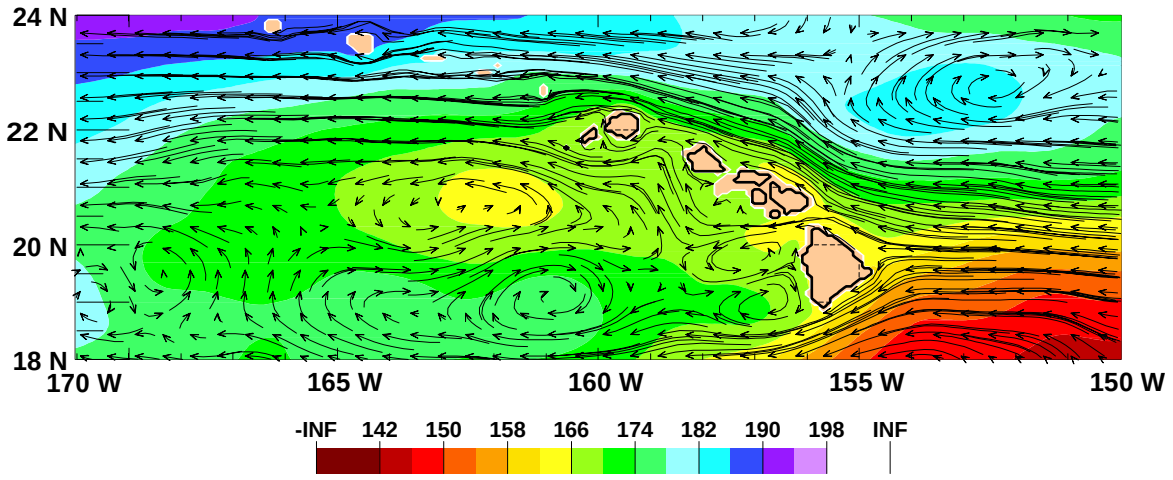

Figure 1: Model results from the region of Hawaii. The surface currents are represented by the arrows. The upper layer thickness is represented by color.

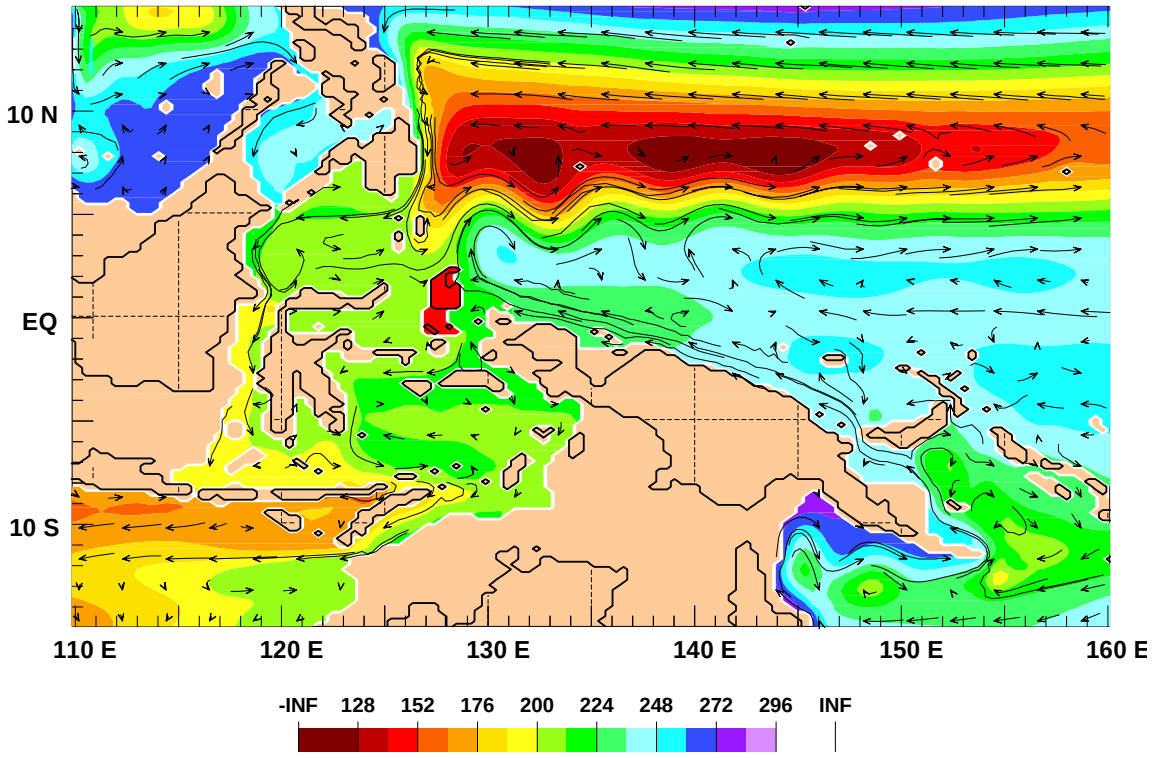

Figure 2: Model results from the region of Hawaii. The surface currents are represented by the arrows. The upper layer thickness is represented by color.